

What is claimed is:

1. A process for catalytic hydrocarbon recombination, in which catalytic hydrocarbon is fractionated in fractionator (1), including fractionating a gasoline fraction and a diesel fuel fraction; wherein the gasoline fraction and diesel fuel fraction are combined, and an intermediate fraction is draw from the gasoline fraction and the diesel fuel fraction; then the intermediate fraction is extracted at a solvent extractor to separate the aromatic fraction and non-aromatic fraction.
2. A process for catalytic hydrocarbon recombination as claimed in claim 1, wherein the intermediate fraction is fractionated by adding one or more side cuts at the middle section of the fractionator 1, the gasoline fractionation, the diesel fuel fractionation and the intermediate fractionation are done at the fractionator 1; the distillation range of the gasoline fraction is controlled at  $35\sim 110^{\circ}\text{C}\pm 30^{\circ}\text{C}$ , the distillation range of the diesel fuel fraction is controlled at  $210\pm 30^{\circ}\text{C}\sim 355\pm 30^{\circ}\text{C}$ , and the distillation range of the intermediate fraction is controlled at  $120\pm 30^{\circ}\text{C}\sim 210\pm 30^{\circ}\text{C}$ .
3. A process for catalytic hydrocarbon recombination as claimed in claim 2, wherein the overhead temperature of the fractionator 1 is  $65\sim 95^{\circ}\text{C}$ , the outlet temperature of the diesel fuel is  $190\sim 280^{\circ}\text{C}$ , the temperature of the side cuts is  $120\sim 260^{\circ}\text{C}$ , the bottom temperature is  $340\sim 385^{\circ}\text{C}$ , the overhead pressure of the fractionator 1 is  $0.11\sim 0.28\text{MPa}$ , the bottom pressure of the fractionator is  $0.12\sim 0.30\text{Mpa}$ .
4. A process for catalytic hydrocarbon recombination as claimed in claim 1, wherein the fractionation is a two- step fractionation: first step, fractionate a gasoline fraction and a diesel fuel fraction, increase the temperature of the fractionator 1 by  $10\sim 15^{\circ}\text{C}$ , control the distillation range of the gasoline fraction 1 at  $35\sim 210^{\circ}\text{C}\pm 30^{\circ}\text{C}$ , and control the distillation range of the diesel fuel fraction at  $210\pm 30^{\circ}\text{C}\sim 355\pm 30^{\circ}\text{C}$ ; pump the gasoline fraction 1 to fractionator 2 for secondary fractionation, an intermediate fraction with the distillation range of  $110\pm 30^{\circ}\text{C}\sim 210\pm 30^{\circ}\text{C}$  is drawn from the bottom of the fractionator 2, and a gasoline fraction with the distillation range of  $35\sim 110^{\circ}\text{C}\pm 30^{\circ}\text{C}$  is drawn from the overhead thereof.

5. A process for catalytic hydrocarbon recombination as claimed in claim 1, wherein the fractionation is a two-step fractionation: first step, fractionate a gasoline fraction and a diesel fuel fraction, reduce the temperature of the fractionator 1 down  $10\sim 40^{\circ}\text{C}$ , control the distillation range of the gasoline fraction 1 at  $35\sim 110^{\circ}\text{C} \pm 30^{\circ}\text{C}$ , and control the distillation range of the diesel fuel fraction 1 at  $110 \pm 30^{\circ}\text{C} \sim 355 \pm 30^{\circ}\text{C}$ ; pump the diesel fuel fraction 1 to fractionator 5 for secondary fractionation, a diesel fuel fraction with the distillation range of  $210 \pm 30^{\circ}\text{C} \sim 355 \pm 30^{\circ}\text{C}$  is drawn from the bottom of the fractionator 5, and an intermediate fraction with the distillation range of  $110 \pm 30^{\circ}\text{C} \sim 210 \pm 30^{\circ}\text{C}$  is drawn from the overhead thereof.
6. A process for catalytic hydrocarbon recombination as claimed in claim 1, claim 2, claim 3 or claim 4, wherein the aromatic hydrocarbon fraction are fractionated at fractionator 3, a high octane number gasoline fraction is separated from the overhead cut of the fractionation 3, and a heavy aromatic hydrocarbon fraction is separated from the bottom thereof; blend the high octane number gasoline fraction with the gasoline fraction, and blend the heavy aromatic hydrocarbon fraction with the diesel fuel fraction.
7. A process for catalytic hydrocarbon recombination as claimed in claim 2, wherein 1 to 4 side cuts are added at the middle section of the fractionator 1 to divide the intermediate fraction into 1~4 distillation ranges.
8. A process for catalytic hydrocarbon recombination as claimed in claim 1, claim 2, claim 3 or claim 4, wherein the aromatic hydrocarbon fraction is used as high quality gasoline directly.
9. A process for catalytic hydrocarbon recombination as claimed in claim 1, claim 2, claim 3 or claim 4, wherein the non-aromatic hydrocarbon fraction is fractionated at fractionator 4, a diesel fuel fraction is separated from the bottom of the fractionator 4, and blend it with the diesel fuel fraction to increase the cetane number of the diesel fuel, or make one or more grades of low condensing point diesel fuel; light non-aromatic hydrocarbons are separated from the overhead of the fractionator 4, the light non-aromatic hydrocarbons are used as chemical light oil, they can also be blended with the gasoline fraction.

10. A process for catalytic hydrocarbon recombination, in which catalytic hydrocarbon is fractionated in the fractionator (1), including fractionating a gasoline fraction and a diesel fuel fraction; recombine the gasoline fraction and the diesel fuel fraction, an intermediate fraction is drawn between the gasoline fraction and the diesel fuel fraction; wherein the intermediate fraction and the gasoline fraction are pumped to a solvent extraction unit to separate the aromatic hydrocarbon fraction and non-aromatic hydrocarbon fraction.
11. A process for catalytic hydrocarbon recombination as claimed in claim 10, wherein one or more side cuts are added at the middle section of fractionator 1 to get an intermediate fraction; the gasoline fraction, diesel fuel fraction and the intermediate fraction are completed at the fractionator 1; the distillation range of the gasoline fraction is controlled at 35~150°C, the distillation range of the diesel fuel fraction is controlled at 170~395°C, the distillation range of the intermediate fraction is controlled at 70~250°C.
12. A process for catalytic hydrocarbon recombination as claimed in claim 10, wherein 2 to 4 side cuts are added at the middle section of the fractionator 1, so as to divide the intermediate fraction into 2 to 4 streams.
13. A process for catalytic hydrocarbon recombination as claimed in claim 12, wherein the overhead temperature of the fractionator 1 is 65~130°C, the outlet temperature of the diesel fuel is 170~250°C, the side cut temperature is 120~240°C, the bottom temperature of the fractionator 1 is 330~385°C, the overhead pressure of the fractionator 1 is 0.15~0.28MPa, the bottom pressure of the fractionator 1 is 0.12~0.30Mpa.
14. A process for catalytic hydrocarbon recombination as claimed in claim 10, wherein the fractionation is a two-step fractionation: first step, fractionate a gasoline fraction and a diesel fuel fraction, increase the temperature of the overhead of fractionator 1 and the temperature of the diesel fuel outlets by 10~50°C; the distillation range of the gasoline fraction is controlled at 35~250°C, the distillation range of the diesel fuel fraction is controlled at 170~395°C; pump the gasoline fraction to fractionator 2 for secondary fractionation, an intermediate fraction with the distillation range of 70~250°C is draw from the bottom of the fractionator 2, a gasoline fraction with the distillation range of

35~150°C is draw from the overhead thereof; pump the intermediate fraction and the gasoline fraction with the distillation range of 35~150°C to a solvent extraction unit to separate aromatic hydrocarbon fraction and non-aromatic hydrocarbon fraction.

- 5 15. A process for catalytic hydrocarbon recombination as claimed in claim 10, wherein the fractionation is a two-step fractionation: first step, fractionate a gasoline fraction and a diesel fuel fraction, reduce the temperature of the overhead of fractionator 1 and diesel fuel outlet by 10~50°C; the distillation range of the gasoline fraction is controlled at 35~150°C, the distillation range of the diesel fuel fraction is controlled at 70~395°C; pump the diesel fuel fraction to fractionator 5 for secondary fractionation, a diesel fuel fraction with the distillation range of 170~395°C is drawn from the side cuts at the bottom of the fractionator 5, an intermediate fraction with the distillation range of 70~250°C is drawn from the overhead thereof; pump the intermediate fraction and the diesel fuel fraction with the distillation range of 170~395°C to a solvent extraction unit to separate aromatic hydrocarbon fraction and non-aromatic hydrocarbon fraction.
- 10
16. A process for catalytic hydrocarbon recombination as claimed in claim 10 to15, wherein the aromatic hydrocarbon fraction are fractionated at fractionator 3, a high octane number gasoline fraction is separated from the overhead of the fractionator 3, a heavy aromatic hydrocarbon fraction is separated from the bottom thereof; the non-aromatic are fractionated at fractionator 4, from the overhead of the fractionator 4 are light gasoline; from the side cuts are light non-aromatic hydrocarbons; from bottom are diesel fuel fraction.
- 15
17. A process for catalytic hydrocarbon recombination as claimed in claim 10 to15, wherein the aromatic hydrocarbon fraction are used as high quality gasoline directly.
- 20
18. A process for catalytic hydrocarbon recombination as claimed in claim 16, wherein the high octane number gasoline fraction are blended with the light gasoline fraction.
- 25
19. A process for catalytic hydrocarbon recombination as claimed in claim 16,
- 30

wherein the heavy aromatic hydrocarbon fraction are blended with the diesel fuel fraction.

20. A process for catalytic hydrocarbon recombination as claimed in claim 16, wherein the diesel fuel fraction are blended with the diesel fuel fraction.

5 21. A process for catalytic hydrocarbon recombination as claimed in claim 16, wherein the light non-aromatic hydrocarbon fraction are blended with the gasoline fraction.

22. A process for catalytic hydrocarbon recombination as claimed in claim 16, wherein the heavy aromatic hydrocarbon fraction are used as independent  
10 products; the diesel fuel fraction serve as the feed for ethylene after hydrogenated; the light non-aromatic hydrocarbon fraction are used as chemical light oils.

23. A process for catalytic hydrocarbon recombination as claimed in claim 16, wherein the high octane number gasoline fraction are blended with the light  
15 gasoline fraction and the light non-aromatic hydrocarbons.

24. A process for catalytic hydrocarbon recombination as claimed in claim 1  
or 10, wherein the water-soluble solvent used for extraction is recycled, the  
regeneration method of the water-soluble solvent is: 1) mix the water-soluble  
solvent with water, the weight ratio of water and the water-soluble solvent is  
20 0.1-10; 2) the mixture is separated by sedimentation, three phases are  
formed, the top layer is oil, the middle layer is the mixture of water-soluble  
solvent and water, the lower layer is insoluble substance; 3) the middle mixed  
phase in step 2) are distilled with the waste heat at atmosphere or vacuum  
condition to get the regenerated water-soluble solvent and water; 4)  
25 discharge the regenerated water-soluble solvent in 3) , cooling the separated  
water; 5) after cooling the water in 4) is re-separated to divide water and oil,  
discharge the recovery water, and mixed with the water-soluble solvent in 1)  
for recycling use.

25. A process for catalytic hydrocarbon recombination as claimed in claim 24,  
30 wherein the mixed phase in step 3) is filtered before distillation.

26. A process for catalytic hydrocarbon recombination as claimed in claim 24,



wherein the weight ratio of the water and the water-soluble solvent is 0.5-3.

27. A process for catalytic hydrocarbon recombination as claimed in claim 24, wherein the weight ratio of the water and the water-soluble solvent is 1-2.

28. A process for catalytic hydrocarbon recombination as claimed in claim 24,  
5 wherein the water-soluble solvent include a mixed solvent of 2 or more water-soluble solvents.

29. A process for catalytic hydrocarbon recombination as claimed in claim 24, wherein the mixed phase in step 3) is filtered for more than one time before distillation.

10 30. A process for catalytic hydrocarbon recombination as claimed in claim 29, wherein the filtration separation is a 2-stage filtration.

31. A process for catalytic hydrocarbon recombination as claimed in claim 29, wherein the filtration separation is 3-stage filtration.

15 32. A process for catalytic hydrocarbon recombination as claimed in claim 30 or 31, wherein the filtration separation is in series.